

RESEARCH AND DEVELOPMENT OF CERAMIC GAS TURBINE ENGINES IN JAPAN

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1. Introduction

The ceramic gas turbine (CGT) engine has significant merits in terms of higher thermal efficiency, lower pollutant emissions and wider fuel capability, as compared to conventional gasoline and diesel engines. As a result, the Ministry of International Trade and Industry (MITI) has undertaken two CGT programs as national projects, in order to bring these advanced technologies to practical use in Japan. The 100kW automotive CGT program was started in fiscal year (FY) 1990 and is scheduled to conclude in FY 1996. This program is supported by the Agency of Natural Resources and Energy (ANRE) of MITI and is being managed by the Petroleum Energy Center (PEC). Secondly, the 300kW industrial CGT program was initiated in FY 1988 and is scheduled to conclude in FY 1998. This program has been carried out by the New Energy and Industrial Technology Development Organization (NEDO) under funding provided by the Agency of Industrial Science and Technology (AIST) of MITI. The organization of the two Japanese CGT programs is shown in Fig. 1. An interim appraisal to the 100kW CGT program was carried out in FY 1993 and of the 300kW

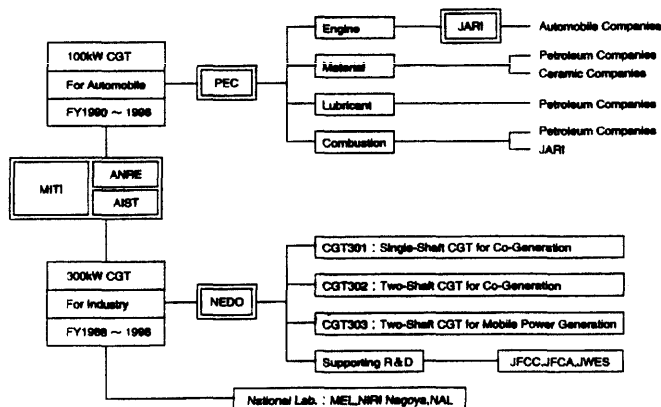


Figure 1. Organization of the two CGT research and development programs in Japan

CGT from FY 1994 to 1995.

2. 100kW Automotive CGT Technologies

2.1 Overview

Development of technologies related to the 100 kW CGT in FY 1995 have progressed in the areas shown in Fig. 2. It may be pointed out that testing of the engine at a turbine inlet temperature (TIT) of 1,350°C has been started. Along with this, the following tasks were also being carried out in order to reach the final targets shown in Fig. 3. These tasks have been carried out with the cooperation of numerous petroleum, ceramics, and automobile companies and the Japan Automobile Research Institute Inc.(JARI). The design, trial production, operation tests, and evaluation of the ceramic components are all being handled by the JARI group. Figure 4 shows the specific development subjects and the cooperative partners.

Elementary research on technology of the low-NOx combustion system, heat- and oxidation-resistant lubricants, high-strength heat-resistant ceramic materials, and the development of engine systems and components are being

1990	1991	1992	1993	1994	1995	1996
Basic Design & Component Development			Component & Engine Development			
			INTERIM APPRAISAL	TIT=1200°C	TIT=1350°C	
Flexible Combustion Technology			Combustor Development			
Lubricants for High Temperature Applications						
Application Technology for Ceramic Matrix Composites						
			Feasibility Study on Application Technologies			

Figure 2. Development schedule for the 100kW CGT research and development project